

## 9.0 Further Black Rock Alternative Investigation Needs

WIS's work conducted to date for Benton County, and Reclamation's work, indicates importing Columbia River water to the Yakima River basin for a water exchange with some lower basin irrigation entities would restore instream flow conditions to some semblance of the natural (unregulated) hydrograph, would improve dry-year water supply conditions for junior irrigation water rights, and would provide additional surface water supply for municipal growth.

A purpose of this Assessment was to complete many technical studies to respond to fundamental questions for the Black Rock alternative. The findings of the technical studies are included in the text of this Summary Report. While many of the questions have been answered, some of the questions require further investigations, if the Black Rock alternative proceeds to the next phase of the Storage Study.

### 9.1 Technical Viability of the Black Rock Alternative

The following discussion identifies specific questions followed by a brief response as organized by the major aspects of the Black Rock alternative.

#### 9.1.1 Exchange Water

Have potential water exchange participants been identified?

**Response:** Yes, Roza and Sunnyside Divisions of the Yakima Project and Terrace Heights, Selah-Moxee, and Union Gap Irrigation Districts are potential water exchange participants.

Can Columbia River water physically be delivered to the potential exchange participants?

**Response:** Yes. The Black Rock alternative could physically deliver Columbia River water to Roza Canal.

Have the potential water exchange participants committed to an exchange?

**Response:** No, but they have indicated a willingness to proceed. A commitment requires defining terms and conditions addressing such items as water service contracts and water rights, reimbursable and nonreimbursable project costs, and operational conditions and costs.

Has the block of exchange water needed to meet the study goals been identified?

**Response:** No, the block of exchange water used in this Assessment is the amount that would fulfill the entire water rights of Roza and Sunnyside Divisions, Terrace Heights and Union Gap Irrigation District, and most of the water rights of Selah-Moxee Irrigation District. While the amount of exchange water needed to meet the dry-year irrigation goal

of Yakima River basin irrigation entities with junior rights is known, the amount could change depending upon which irrigation entities actually participate in an exchange. Also, the amount required for the instream flow targets is unknown at this time. The hydrographs in section 8.1 show how this specific block of exchange water could be managed to best mimic the natural (unregulated) hydrograph. Future investigations are necessary to identify fishery habitat improvements, production, escapement, and ultimately, fishery monetary benefits associated with blocks of exchange water. These investigations would help arrive at a preferred Black Rock water exchange concept and alternative configuration.

### 9.1.2 Water Supply

Is Columbia River water available to divert?

**Response:** Yes, there is water in excess of current instream flow targets in the Columbia River. However, preliminary information provided as a part of the State's Columbia River Initiative (which is being referred to the 2005 State Legislature) suggests no diversions from April 1 through August 31 of each year without payment into a mitigation account. Therefore, it may be desirable to reexamine the water availability assessment [3] to determine if there is adequate supply for diversion to a Black Rock reservoir outside of these months.

Can State authorization for diversion of Columbia River water be obtained?

**Response:** This is unknown at this time. Washington State needs to address Columbia River water policy.

Are the Columbia River and Yakima River hydrologic models compatible to determine the net streamflow effects of Columbia River diversions to a Black Rock reservoir?

**Response:** No, the Columbia River hydrologic model uses the 1929-1978 historic period of record while the Yakima River model uses the 1981-2003 historic period of record. This difference makes it difficult to determine the exact impacts of the exchange on Columbia River flows downstream from the mouth of the Yakima River. Future work would include making the models compatible with similar periods of record.

### 9.1.3 Pump/Generation

Is pump/generation financially viable?

**Response:** Financial viability of pump/generation is unknown at this time. Information provided to date indicates that pump/generation would not be financially viable. However, exchange proponents have considerable interest in pump/generation for possible use with wind energy. Specific work could be undertaken regarding operating a Black Rock reservoir in pump/generation mode, sizing of a pumping plant for reservoir refill to ensure the delivery of exchange water, and the marketability of generated power.

### 9.1.4 Storage Dam

Is there a viable damsite in Black Rock Valley?

**Response:** Yes, however, it may require extensive excavation of material (possibly up to a depth of 200 feet) to provide a suitable dam foundation. Further geologic exploration is needed to better define the depth to bedrock.

Is there potential for major earthquakes at this damsite?

**Response:** Yes. The initial assessment of the level of earthquake ground motion that the Black Rock damsite could experience identified several areas of uncertainty in the seismic hazard conclusions. These uncertainties include details of the geologic structure and ages of faulting and folding. Further investigations of the Black Rock Valley fault and the Yakima Fold Belt are needed to guide future engineering decisions for design of a storage dam and related facilities.

Has the type of storage dam most suitable for this site been determined?

**Response:** Yes. Appraisal-level cost estimates for the rockfill embankment dams are significantly lower than the cost estimates for the roller compacted concrete dams; therefore, the roller compacted concrete dams should be removed from further evaluation. Also, there is not a significant cost difference between the concrete face rockfill and central core rockfill embankment dams. Both of these embankment dams should receive further evaluation.

### 9.1.5 Reservoir

Has the preferred design for conveying Columbia River water to the reservoir been determined?

**Response:** Yes, the appraisal-level cost estimate for the all tunnel inflow conveyance system is significantly less than the cost estimate for the tunnel/pipeline inflow conveyance system; therefore, only the all tunnel option should receive further evaluation.

Can the reservoir basin retain stored water?

**Response:** This is unknown at this time. The Pomona Basalt Formation appears to be a hydraulic barrier to downward seepage, at least at the site of the initial hydrologic testing. However, if vertical joints and fractures exist in the Pomona Basalt elsewhere in the reservoir basin, significant leakage from the reservoir could occur. Should reservoir leakage reach the geologic units that underlie the Pomona Basalt, there could be significant regional effects on the groundwater system. Future investigations would include working with the Pacific Northwest National Laboratory to estimate potential leakage and the impact to the Hanford Site. Further investigations are necessary to characterize the leakage potential of geologic units around the reservoir site.

In addition, current information indicates permeable geologic units may be exposed or covered only by a thin soil layer on the dam abutments and reservoir rim. Depending on the structure and fracturing of these units, significant reservoir leakage could occur.

## CHAPTER 9.0 FURTHER BLACK ROCK ALTERNATIVE INVESTIGATIONS

Exploratory drilling is required along the reservoir rim to determine the geologic structure of the potential leakage areas. Further hydrologic testing is also required within the reservoir basin to substantiate the hydrologic conditions within the Pomona Basalt.

Have the reservoir size and pump capacity been determined?

**Response:** The exact reservoir size and pump capacity are unknown at this time. The appraisal-level cost estimates for the large reservoir pump only option (1,300,000-acre-foot active capacity with 3,500-cfs pump capacity) and the small reservoir pump only option (800,000-acre-foot active capacity with 6,000-cfs pump capacity) are the same. Both reservoir sizes should receive further evaluation. Further analysis of the extent of the water exchange, timing of Columbia River water availability and diversions, economics, and other aspects would help refine the most desirable storage/pump option.

### 9.1.6 Irrigation Delivery Systems

Have plans been developed for delivery of exchange water to potential exchange participants?

**Response:** Yes. However, there are still questions regarding the type and extent of the systems. There is a need to maintain the existing systems to allow diversion of Yakima River March flood waters for system priming and for use in an emergency should there be an extended outage of the Black Rock alternative facilities. Three upstream delivery plans and two downstream plans should receive further evaluation.

Is hydropower generation viable within the irrigation delivery system?

**Response:** Yes. These facilities appear technically viable, but no analysis has been prepared to determine their financial viability. Power generation sites are identified at the delivery locations of the Black Rock alternative water to both Roza and Sunnyside Canals. At the delivery location to Roza Canal, hydraulic capacities were identified for a 1,500-cfs and a 900-cfs powerplant. The powerplant field construction cost difference between the two capacities is less than 2 percent. The hydraulic capacity of a powerplant at Sunnyside Canal would be 900 cfs. All three powerplant options should receive further evaluation.

### 9.1.7 Cultural Resources

Are the cultural resources of the Black Rock site known?

**Response:** No, further work is necessary to develop a historic and ethnographic overview of the area. Then the appropriate field surveys would be conducted to identify and evaluate sites and cultural properties. This work would be accomplished in cooperation with the Yakama Nation and other interested entities.

### 9.1.8 Fish and Wildlife Resources

Have potential fish and wildlife issues associated with the Black Rock alternative been identified and evaluated?

**Response:** Yes. Potential fish and wildlife issues have been identified. The most significant issue appears to be the potential for false attraction of migrating Columbia River salmonids into the Yakima River basin. This is associated with the use of Columbia River water as an exchange irrigation water supply and the possible effects of surface and subsurface irrigation return flows entering the Yakima River.

### 9.1.9 Cost Estimates

Have annual operation and maintenance costs for the Black Rock alternative been determined?

**Response:** No. Annual costs for operation and maintenance of potential Black Rock facilities would be developed to compare storage alternatives.

Are the field construction cost estimates presented in this Summary Report of adequate detail to establish an alternative cost ceiling?

**Response:** No. The field cost estimates presented in this Summary Report are appraisal level based on available, but limited, field data and preliminary designs. The field costs were estimated for the purpose of screening facility options and developing preliminary configurations of the Black Rock alternative. Additional costs (termed noncontract costs) would be incurred once a proposed Federal water resource project was authorized and construction appropriations were provided by Congress. Further field investigations and design data development are necessary to prepare feasibility-level total project cost estimates that would become the basis for determining a project cost ceiling for project authorization.

### 9.1.10 Economic Justification and Financial Viability

Has the economic justification of the Black Rock alternative been determined?

**Response:** No. Economic justification involves comparison of estimated alternative benefits and costs. Work has begun on the benefit unit values, but the final values have not been determined.

Has the financial viability of the Black Rock alternative been determined?

**Response:** No. Financial viability involves a cost allocation to determine reimbursable and nonreimbursable project costs and the manner of repayment of reimbursable costs. A cost allocation requires estimated benefits associated with each project purpose. As indicated above, project benefits have yet to be determined.

### 9.2 Conclusions

This Assessment has identified no technical reason to eliminate the Black Rock alternative from further investigation. Studies to date have identified several areas of uncertainty and concern that must be examined further. Of concern is the question of potential reservoir leakage. The results of further examinations could have negative implications as to the Black Rock alternative viability or costs.

Based upon currently available information and the appraisal-level designs prepared for this Assessment, it is reasonably certain the construction of facilities to pump, store, and deliver Columbia River water to willing exchange participants in the Yakima River basin would be technically viable.

If the Congress provides funding for the Storage Study beyond fiscal year 2005, the Storage Study plan formulation phase would compare all potential storage opportunities (such as a Bumping Lake enlargement, a new Wymer dam and reservoir, and a Keechelus to Kachess pipeline), and a viable alternative(s) would be selected for the feasibility phase. Whether the Black Rock alternative would be among the alternatives examined in the plan formulation phase would depend upon whether Reclamation decides to carry that alternative forward. The feasibility phase, the last phase of the Storage Study, would include detailed evaluation of selected alternative(s) to meet the Study Storage objectives in terms of engineering, economic and environmental considerations, and cultural and social acceptability. Preparation of the Feasibility Report/Environmental Impact Statement would be a part of this final phase.

## 10.0 References

- [1] Washington State Department of Natural Resources. 1993. *A Solution to A Dilemma In The Yakima River Basin*. April 14, 1993.
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- [3] U.S. Department of the Interior. Bureau of Reclamation. 2004. *Preliminary Appraisal Assessment of Columbia River Water Availability for A Potential Black Rock Project, Technical Series No. TS-YSS-1*. March 18, 2004. Pacific Northwest Regional Office. Boise, Idaho.
- [4] NOAA Fisheries. 2000. *Endangered Species Act – Section 7 Consultation, Biological Opinion, Reinitiation of Consultation of Operation of the Federal Columbia River Power System, Including Juvenile Fish Transportation Program and 19 Bureau of Reclamation Projects in the Columbia River Basin*. December 21, 2000. National Marine Fisheries Service. Northwest Region.
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- [6] U.S. Department of the Interior. Bureau of Reclamation. 2004. *Appraisal Assessment of the Black Rock Alternative Facilities and Field Cost Estimates, Technical Series No. TS-YSS-2*. December 2004. Technical Services Center. Denver, Colorado.
- [7] U.S. Department of the Interior. Bureau of Reclamation. 2004. *Appraisal Assessment of the Black Rock Alternative Delivery System for Roza, Terrace Heights, Selah-Moxee, and Union Gap Irrigation Districts, Technical Series No. TS-YSS-3*. December 2004. Pacific Northwest Construction Office. Yakima, Washington.
- [8] U.S. Department of the Interior. Bureau of Reclamation. 2004. *Appraisal Assessment of the Black Rock Alternative Delivery System for Sunnyside Division, Technical Series No. TS-YSS-4*. December 2004. Pacific Northwest Regional Office. Boise, Idaho.
- [9] U.S. Department of the Interior. Bureau of Reclamation. 2004. *Appraisal Assessment of Geology at a Potential Black Rock Damsite, Technical Series No. TS-YSS-5*. December 2004. Pacific Northwest Region. Boise, Idaho.
- [10] Columbia Geotechnical Associates, Inc. 2004. *Geologic Investigation Black Rock Dam Alternate Dam Site Yakima County, Washington*. February 12, 2004.



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- [12] U.S. Department of the Interior. Bureau of Reclamation. 2004. *Appraisal Assessment of Hydrogeology at a Potential Black Rock Damsite, Technical Series No. TS-YSS-6*. December 2004. Pacific Northwest Region. Boise, Idaho.
- [13] Spane, Frank. 2004. Battelle Memorial Institute. *The Black Rock Reservoir Study – Results of the FY 2004 Borehole Hydrologic Field Testing Characterization Program*. November 18, 2004.
- [14] U.S. Department of the Interior. Bureau of Reclamation. 2004. *Technical Memorandum No. D-8330-2004-14. Black Rock Dam Yakima River Basin Storage Feasibility Study, Washington, Probabilistic Seismic Hazard Assessment for Appraisal Studies of the Proposed Black Rock Dam*. July 2004. Technical Services Center. Denver, Colorado.
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- [16] U.S. Department of the Interior. Bureau of Reclamation. 1999. *Yakima River Basin Water Enhancement Project, Washington, Final Programmatic Environmental Impact Statement*. January 1999. Upper Columbia Area Office. Yakima, Washington.
- [17] Richter, Brian D.; Baumgartner, Jeffrey V.; Wigington, Robert; and Braun, David F. 1997. *How much water does a river need?* 1997. *Freshwater Biology*. 37. 231-249.
- [18] Yakima River Basin Watershed Planning Unit and Tri-County Water Resources Agency. 2003. *Watershed Management Plan Yakima River Basin*. Prepared by Economic and Engineering Services, Inc. January 2003.
- [19] U.S. Department of the Interior. Bureau of Reclamation. 2002. *Interim Comprehensive Basin Operating Plan for the Yakima Project, Washington*. Chapter 5: Current Project Operations/Total Water Supply Available. November 2002. Upper Columbia Area Office. Yakima, Washington.
- [20] Grant County Pubic Utility District. 2003. *Priest Rapids Hydroelectric Project No. 2114, Public Utility District No. 2 of Grant County, Washington, Final Application for New License, Exhibit E-4 Report on Fish Resources*. 2003. Public Utility District No. 2 of Grand County, Washington.
- [21] Biology Technical Work Group. 2004. *Defining Fish and Wildlife Resource Issues for the Yakima River Basin Water Storage Feasibility Study*. August 2004.



## **Appendix A**

**Reclamation's December 28, 2004, letter  
requesting a Columbia River water withdrawal**

## APPENDIX A – 2004 WITHDRAWAL REQUEST

## APPENDIX A – 2004 WITHDRAWAL REQUEST



IN REPLY  
REFER TO:

### United States Department of the Interior

BUREAU OF RECLAMATION  
Pacific Northwest Region  
1150 North Curtis Road, Suite 100  
Boise, Idaho 83706-1234

DEC 28 2004

PN-1000  
WTR-4.10

#### OVERNIGHT EXPRESS

Mr. Joe Stohr  
Water Resource and Program Manager  
Washington State Department of Ecology  
P.O. Box 47600  
Olympia, WA 98504-7600

Subject: Withdrawal of Water for Yakima Basin Storage from the Columbia River Basin

Dear Mr. Stohr:

Please take notice that pursuant to the Act of Congress of June 17, 1902, (32 Stat.388), and acts amendatory thereof and supplementary thereto, the United States intends to make examinations and surveys for the utilization of the unappropriated waters of the Columbia River and its tributaries as may be required for operation of storage and distribution facilities under the Act of February 20, 2003 (PL 108-7). These examinations and surveys are more commonly referred to as the Yakima Basin Storage Study.

The United States provides the foregoing notice pursuant to the Revised Code of Washington section 90.40.030 with the understanding that those waters will not be subject to appropriation by others during the initial period stated in said section, and during such further time or times after said period as may be granted thereunder.

Please take further notice that the list of lands attached hereto, identified as Exhibit "A" and made part hereof is a list of lands owned by the State of Washington, over and upon which the United States requires rights of way for canals, ditches, laterals and sites for reservoirs and structures appurtenant thereto, along with such additional rights of way and quantities of land as may be required for the operation and maintenance of the completed works for the proposed Black Rock project. Please file this notice, together with the attached list, in your office, as a reservation from sale or other disposition of such lands, so described, by the State of Washington.

## APPENDIX A – 2004 WITHDRAWAL REQUEST

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Should you desire any further information concerning the proposed use of these waters by the United States, please feel free to contact me and I will furnish it to you promptly.

Sincerely,

A handwritten signature in black ink, appearing to read "J. William McDonald". The signature is fluid and cursive, with a large, stylized "J" and "M".

J. William McDonald  
Regional Director

Enclosure

cc: Mr. Doug Sutherland  
Commissioner of Public Lands  
Washington Department of Natural Resources  
P.O. Box 47001  
Olympia WA 98504-7001

## APPENDIX A – 2004 WITHDRAWAL REQUEST

### Exhibit A

#### **List of Washington State lands to be withdrawn under RCW 90.40 related to the Black Rock Project**

Legal descriptions below encompass, but are not necessarily co-extensive with Washington State lands.

All of Section 16	T 11 N, R 23 E, W.M.
All of Section 20	T 11 N, R 23 E, W.M.
S1/2 N1/2 Section 16	T 12 N, R 20 E, W.M.
All of Section 16	T 12 N, R 21 E, W.M.
NE1/4 Section 27	T 12 N, R 21 E, W.M.
SE1/4 SE1/4 Section 13	T 12 N, R 22 E, W.M.
N1/2 Section 30	T 12 N, R 22 E, W.M.
All of Section 16	T 12 N, R 23 E, W.M.
All of Section 36	T 13 N, R 23 E, W.M.
N1/2 N1/2 Section 2	T 14 N, R 23 E, W.M.
S1/2 Section 35	T 14 N, R 23 E, W.M.

## APPENDIX A – 2004 WITHDRAWAL REQUEST

## **Appendix B**

**Washington Infrastructure Services, Inc.'s  
review comments on  
Reclamation's *Appraisal Assessment of the  
Black Rock Alternative Facilities and Field  
Cost Estimates, Final Report,  
Technical Series No. TS-YSS-2***



## APPENDIX B — WIS'S REVIEW COMMENTS

## Reclamation’s explanation of the differences in table 7-2 of the Summary Report and WIS’s table on “Comparison of WIS and BOR Estimated Costs for Black Rock Reservoir”

Reclamation’s field cost estimate of \$2.7 billion referred to on the first page of the November 30, 2004, letter from Dick Fotheringham, and shown in column 10 of the table “Comparison of WIS and BOR Estimated Costs for Black Rock Reservoir,” is different than the cost shown on table 7-2 of this Summary Report. This is explained as follows:

- The “Subtotal direct costs” on the WIS comparison table is referred to as “Subtotal of pay items” in table 7-2.
- The cost differences between the two tables are:

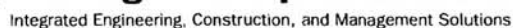
Feature	WIS Comparison Table Column 10	Reclamation’s Table 7-2 Large Reservoir Pump/Generation Option
Direct cost	\$1,888,566,350	
Black Rock dam		- \$41,216,000 <sup>12</sup>
Sunnyside powerplant and bypass		+\$32,302,450 <sup>13</sup>
Difference		-\$8,913,550
Subtotal of pay items		\$1,879,652,800
Mobilization	\$95,000,000	\$94,600,000
Unlisted items	\$186,433,650	\$182,747,200
Contingencies	\$530,000,000	\$540,000,000
Subtotal	\$811,433,650	\$817,347,200
Total field cost	\$2,700,000,000	\$2,697,000,000

<sup>12</sup> Reclamation used the central core rockfill dam in its three project configurations while the WIS comparison table shows the concrete face rockfill dam

<sup>13</sup> The WIS comparison table does not include the Sunnyside powerplant and bypass which Reclamation included at Sunnyside Canal MP 3.83.

## APPENDIX B — WIS'S REVIEW COMMENTS

PRJZ.u



Mr. Kim McCartney  
U S Department of the Interior  
Bureau of Reclamation  
Upper Columbia Area  
1917 Marsh Road  
Yakima, WA 98901

Dear Mr. McCartney:

This letter responds to your request to review and comment on the Bureau's estimated cost to implement a water exchange scheme involving pumping water from the Columbia River to a new reservoir in Black Rock Valley including an outlet system that would deliver water from the Black Rock Reservoir to a portion of the existing irrigation system within the Yakima Valley. For this review, Washington utilized a "Draft Final" version of the Bureau report, "Black Rock Project Facilities and Cost Estimate for Black Rock Project Assessment Draft Report of Findings," dated August 20, 2004.

Washington Infrastructure Services (WIS), under contract to Benton County, completed a reconnaissance level study of multiple alternative arrangements to supply water from the Columbia River to the Black Rock Reservoir and the Roza Irrigation District in May 2002. Subsequently, the Bureau performed a pre-feasibility study for a scheme of which the general characteristics are very similar to the recommended scheme developed by WIS. The estimated cost, in 2002 dollars of the WIS recommended scheme is \$1,569,675,000; with the addition of mobilization for those features that did not have mobilization and escalated to July 2004 dollars (by using the BOR's CCT), the cost is \$1,776,446,000. The Bureau's estimated cost for the project, in June 2004 dollars is \$2,700,000,000, or \$923,554,000 higher than the WIS cost estimate adjusted to the same timeframe (and mobilization).

Attached is a two-page "Review of Cost Estimates" summary that discusses the four largest cost differences between the two estimates. In addition, the attached spreadsheet table, titled "Comparison of WIS and BOR Estimated Costs for Black Rock Reservoir" shows original and adjusted WIS estimated values, and differences between WIS and BOR values for features of the Black Rock Reservoir Project. In summary fashion, these differences, from the largest to the least, are as follows:

BUREAU OF RECLAMATION OFFICIAL FILE COPY			
MAIL CODE	ACTION	INIT & DATE	COPY
1000			
1100		<i>JLB 12/13</i>	
1200			
1600			
1700			
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5000			
<i>1120</i>		<i>KJM 12/13</i>	
<i>1108</i>			
ACTION TAKEN:			
FOLDER #: <i>2949</i>			
CONTROL #: <i>5062188</i>			

## APPENDIX B — WIS'S REVIEW COMMENTS

Mr. McCartney  
November 17, 2005  
Page 2

Mobilization, Unlisted Items and Contingencies	\$416,460,035
Concrete Faced Rockfill Dam:	\$286,559,043
Priest Rapids Pump/Generator Plant	\$100,318,302
Roza Canal Outlet Facility	\$ 78,877,202
Total, Four Largest Items	<u>\$882,214,582</u>

The Bureau uses a larger contingency than did WIS in the first item. This reflects the Bureau's practice. For the Concrete Faced Rockfill Dam, the WIS estimate is based on an assumed excavation depth of 20 feet to the foundation level; this was increased after subsurface explorations showed a potential depth to foundation level of 200 feet. The WIS estimate was not adjusted for this situation that was identified after the WIS Final Report had been issued. Much of this increased is due to the difference in the depth to the foundation and is therefore a requirement.

For the Priest Rapids Pump/Generator Plant, the Bureau utilized a larger facility with more units than did the WIS arrangement, resulting in a significant cost difference. The Bureau's design represents what they would build. Similarly, the Roza Canal Outlet Facility is larger and more sophisticated than that provided by WIS. The Bureau design represents what they believe is necessary to discharge the water into the irrigation systems.

This review is not designed as a challenge to the Bureau's arrangement. Most of the cost differences involve the manner by which the Bureau decided to design each facility, and the magnitude of contingency they have assigned to the estimate. Only the dam cost increase can be explained primarily as the result of a change in knowledge about the site and what is required to construct a large dam such as Black Rock.

If you have any questions or comments, please feel free to call me at (425) 451-4566.

Very truly yours,

  
Dick Fotheringham  
Manager of Engineering

JRF:jrf/Ltr\_USBR-11-30-04

Attachments as noted

cc:

Gary Ballew, Benton County Deputy Administrator

BLACK ROCK RESERVOIR

REVIEW OF COSTS ESTIMATES  
BETWEEN WASHINGTON INFRASTRUCTURE SERVICES AND  
UNITED STATES BUREAU OF RECLAMATION

LARGEST COST DIFFERENCES (Jun/Jul 2004 dollars)

1 - Mobilization, Unlisted Items and Contingencies:

WIS adjusted Estimate: \$394,973,615

USBR Estimate: \$811,434,650

Difference: \$416,460,035

Comments:

- a) WIS adjusted Mobilization costs included.
- b) USBR utilizes a category, "Unlisted Items" to cover potential items not identified at this stage of the estimate. This is really a form of contingency.
- c) USBR utilizes a larger contingency than WIS.

2 - Concrete Faced Rockfill Dam:

WIS adjusted Estimate: \$487,936,957

USBR Estimate: \$774,496,000

Difference: \$286,559,043

Comments:

- a) Geotechnical explorations indicating a need to excavate up to 200 feet below grade were not available when WIS made their estimate. WIS estimated a nominal 20 feet of excavation; geotechnical exploration made after WIS report was completed identify a need to go to the greater depth.



3 - Priest Rapids Pump/Generator Plant:

WIS adjusted Estimate:	\$125,936,578
USBR Estimate:	\$226,254,880
Difference:	\$100,318,302

Comments:

- a) WIS utilized a two unit arrangement requiring a 160 ft by 50 ft structure.
- b) USBR utilized 5 pump units and 2 generating units requiring a 480 ft by 140 ft structure.
- c) The USBR design provides a high degree of versatility.

4 - Roza Canal Outlet Facility:

WIS adjusted Estimate:	\$ 25,133,333
USBR Estimate:	\$104,010,535
Difference:	\$ 78,877,202

Comments:

- a) WIS utilized a 2 unit arrangement requiring a 86 ft by 65 ft structure.
- b) USBR used a single generating unit with 4 energy dissipating valves requiring a 214 ft by 94 ft structure.
- c) The USBR arrangement can provide water even if the generating unit is not operating.

Total estimated cost difference among the four biggest items: \$882,214,582



## COMPARISON OF WIS and BOR ESTIMATED COSTS for BLACK ROCK RESERVOIR

[1] Ref No.	[2] Feature	[3] Original WIS Est. (Oct '01)	[4] WIS Est. Adj by BOR (Jul '04)	[5] BOR Escalation Coln [3] to [4] (Percent)	[6] Escal using BOR CCT (see Ref)	[7] Ref Row # Escal Factor (See Ref)	[8] WIS Est. w/ Escalation Coln [3] X [6] (Percent)	[10] BOR Est. (Jun '04)	[11] BOR Est. minus WIS Esc by BOR to Jul '04	[12] BOR Est. minus WIS Esc by CC1 to Jul '04	[13] Comments
1	Priest Rapids Fish Screen & Intake	73,000,000	77,800,000	6.58%	111.40%	#8	81,324,561	64,551,120	-13,248,880	-16,773,441	
2	Priest Rapids Pump/Generating Plant	115,700,000	122,900,000	6.22%	109.36%	#7	125,936,578	226,254,880	103,354,880	100,318,302	
3	Inflow Conveyance (PG Plant to Blk Rock Res)	183,200,000	195,300,000	6.60%	109.38%	#22	200,375,000	186,471,700	-8,828,300	-13,903,300	
4	Black Rock Inlet/Outlet Tower (PG Plant to Blk Rock Res)	89,620,000	98,100,000	9.46%	111.40%	#8	99,839,825	85,565,400	-12,534,600	-14,274,425	
5	Concrete Faced Rockfill Dam	440,100,000	471,200,000	7.07%	110.87%	#2	487,936,957	774,496,000	303,296,000	286,559,043	
6	Spillway/Saddle Dam	620,000	700,000	12.90%	114.15%	#3	707,736	0	-700,000	-707,736	
7	Low Level Outlet Works	30,000,000	32,800,000	9.33%	113.30%	#4	33,991,416	83,494,115	50,694,115	49,502,699	
8	Black Rock Outlet Structure (Blk Rock Res to Roza Canal)	70,000,000	74,600,000	6.57%	111.40%	#8	77,982,456	3,269,850	-71,330,150	-74,712,606	
9	Outflow Conveyance (Blk Rock Res to Roza Canal)	224,300,000	237,400,000	5.84%	107.78%	#17	241,755,253	303,132,750	65,732,750	61,377,497	
10	Roza Canal Outlet Facility	23,200,000	24,700,000	6.47%	108.33%	#12	25,133,333	104,010,535	79,310,535	78,877,202	
11	Project Roads	6,000,000	6,300,000	5.00%	108.15%	#32	6,489,270	57,320,000	51,020,000	50,830,730	
12	Subtotal Direct Costs	1,255,740,000	1,341,800,000	6.85%			1,381,472,385	1,888,566,350	546,766,350	507,093,965	Subtotal Direct
13	Mobilization	0	0			note 1	39,685,000	95,000,000	95,000,000	55,315,000	Mobilization
14	Unlisted Items	0	0				0	186,433,650	186,433,650	186,433,650	Unlisted Items
15	Contingencies	313,935,000	335,450,000	6.85%			355,288,615	530,000,000	194,550,000	174,711,385	Contingencies
16	Total Field Cost	1,569,675,000	1,677,250,000	6.85%			1,776,446,000	2,700,000,000	1,022,750,000	923,554,000	Total Field Cost

## Column Notes

[1] Reference Number

[2] List of Features

[3] Original Washington Group Conceptual Level Construction Cost Estimates, in October 2001 US Dollars

[4] Values from Coln [3] escalated by BOR to Jun/Jul 2004 US Dollars

[5] Calculation of escalation percentages used by BOR = Coln [4]/Coln[3] - 1.00, expressed as Percentage

[6] Values to escalate Washington Group original estimates from October 2001 to July 2004 (see spreadsheet "BORCCT1.xls")

[7] Reference Row No. in spreadsheet "BORCCT1.xls" that was used for values in Coln [6]

[8] Escalation of Washington Group original Estimate using BOR CCT values given in Coln [6]. Values in July 2004 US Dollars; plus Mobilization Allowance of 5% applied to all features, except I/O Tower (#4) and Conc Faced Rockfill Dam (#5)

[9] Spot check of Feature estimates using escalation rates suggested by A. Binger. Values in July 2004 US Dollars

[10] Bureau of Reclamation (BOR) Cost Estimates in Jun 2004 US Dollars

[11] BOR estimate minus WIS estimate, as escalated by BOR, both estimates in Jun/Jul 2004 US Dollars; Coln[10] - coln [4].

[12] BOR estimate minus escalated WIS estimate (using BOR CCT values), both estimates in Jun/Jul 2004 US Dollars; Coln[10] - coln [8].

[13] Comments

## Other Notes

note 1: mobilization, at the rate of 5% of direct cost, added for features 1,2,3,6,7,8,9,10, and 11; features 4 and 5 have mobilization included in the unit rate for those items.

# APPENDIX B – WIS'S REVIEW COMMENTS

Benton Co.

## BUREAU OF RECLAMATION CONSTRUCTION COST TRENDS

Rev 10/26/04

CONSTRUCTION INDEXES	Escal factor 10/01 to 7/04			Row Ref
	Oct-01	Jul-04	Ratio Jul 04 to Oct 01	
Earth Dams	201	226	112.4%	1
Dam Structure	184	204	110.9%	2
Spillway	212	242	114.2%	3
Outlet Works	233	264	113.3%	4
Concrete Dams	229	251	109.6%	5
Diversion Dams	231	254	110.0%	6
Pumping Plants	235	257	109.4%	7
Structures and Improvements	228	254	111.4%	8
Equipment	247	264	106.9%	9
Pumps and Prime Movers	252	267	106.0%	10
Accessory Elect + Misc. Equip.	240	261	108.8%	11
Powerplants	240	260	108.3%	12
Structures and Improvements	228	254	111.4%	13
Equipment	249	265	106.4%	14
Turbines and Generators	252	267	106.0%	15
Accessory Elect + Misc. Equip	236	257	108.9%	16
Steel Pipelines	257	277	107.8%	17
Concrete Pipelines	231	251	108.7%	18
Canals	224	251	112.1%	19
Canal Earthwork	209	233	111.5%	20
Canal Structures	235	261	111.1%	21
Tunnels	256	280	109.4%	22
Laterals and Drains	243	288	118.5%	23
Lateral Earthwork	206	229	111.2%	24
Lateral Structures	263	323	122.8%	25
Distribution Pipelines	232	253	109.1%	26
Switchyards and Substations	235	256	108.9%	27
Wood Pole Transmission Lines	203	231	113.8%	28
Poles and Fixtures	197	232	117.8%	29
Overhead Conductors and Devices	213	232	108.9%	30
Steel Tower Transmission Lines	233	254	109.0%	31
Primary Roads	233	252	108.2%	32
Secondary Roads	273	284	104.0%	33
Bridges	257	281	109.3%	34
General Property - Buildings	231	261	113.0%	35
OTHER INDICATORS				
Composite Trend	236	265	112.3%	36
Machinery and Equipment (BLS)	240	252	105.0%	
Federal Salary	245	280	114.3%	



Benton Co.

## BUREAU OF RECLAMATION CONSTRUCTION COST TRENDS

Rev 10/26/04

CONSTRUCTION INDEXES	2001				2002				2003				2004				2005		
	JAN	APR	JUL	OCT	JAN	APR	JUL	OCT	JAN	APR	JUL	OCT	JAN	APR	JUL	OCT	JAN	APR	JUL
Earth Dams	203	200	200	201	198	198	203	207	209	214	213	214	217	222	226				
Dam Structure	185	183	184	184	180	180	185	188	190	198	194	195	196	200	204				
Spillway	215	212	211	212	209	210	215	220	221	226	225	228	231	238	242				
Outlet Works	233	232	232	233	232	233	238	242	242	246	247	250	253	259	264				
Concrete Dams	231	229	229	229	228	228	232	236	237	240	241	243	245	248	251				
Diversions Dams	229	229	229	231	231	231	234	236	237	241	242	243	244	250	254				
Pumping Plants	232	233	234	235	236	237	239	241	242	244	246	247	248	253	257				
Structures and Improvements	225	225	226	228	228	229	231	233	235	238	239	240	241	249	254				
Equipment	243	244	245	247	249	250	253	253	254	256	257	258	260	262	264				
Pumps and Prime Movers	248	249	250	252	254	255	257	257	258	259	261	261	262	265	267				
Accessory Elect + Misc. Equip.	236	236	238	240	242	242	246	247	248	250	253	254	256	259	261				
Powerplants	237	237	239	240	241	242	245	246	247	249	250	252	253	257	260				
Structures and Improvements	225	225	226	228	228	229	231	233	235	238	239	240	242	249	254				
Equipment	245	245	247	249	250	251	254	255	255	257	258	260	261	263	265				
Turbines and Generators	248	248	250	252	253	254	257	258	258	260	261	263	264	266	267				
Accessory Elect + Misc. Equip.	233	233	235	236	238	239	242	243	243	245	247	248	250	254	257				
Steel Pipelines	252	253	255	257	258	259	262	264	266	268	270	271	273	275	277				
Concrete Pipelines	226	227	230	231	232	233	236	237	238	242	243	244	244	248	251				
Canals	222	221	222	224	222	223	226	229	232	237	236	238	239	246	251				
Canal Earthwork	211	209	209	209	205	205	210	213	216	225	220	222	223	228	233				
Canal Structures	231	232	233	235	236	236	239	241	243	246	247	249	250	257	261				
Tunnels	252	253	254	256	256	257	260	261	262	265	266	268	269	275	280				
Laterals and Drains	241	240	241	243	242	243	246	251	255	261	260	262	263	277	288				
Lateral Earthwork	207	205	205	206	203	203	207	211	213	221	217	219	220	225	229				
Lateral Structures	260	260	261	263	264	265	268	274	278	284	285	287	289	307	323				
Distribution Pipelines	226	227	230	232	232	234	237	238	239	242	244	245	246	250	253				
Switchyards and Substations	232	231	233	235	235	236	239	240	241	241	243	244	246	251	256				
Wood Pole Transmission Lines	200	200	203	203	201	205	205	205	205	204	206	210	211	222	231				
Poles and Fixtures	189	190	196	197	194	201	200	201	199	197	201	206	207	219	232				
Overhead Conductors and Devices	216	214	214	213	212	212	213	212	214	215	216	217	220	227	232				
Steel Tower Transmission Lines	233	233	233	233	233	233	234	234	234	235	236	236	238	247	254				
Primary Roads	229	228	232	233	231	230	233	235	237	240	241	241	242	248	252				
Secondary Roads	258	260	273	273	264	255	262	264	269	279	280	278	280	282	284				
Bridges	250	251	255	257	257	255	259	261	264	269	270	271	273	278	281				
General Property - Buildings	228	228	230	231	233	234	237	238	238	240	243	246	247	256	261				
OTHER INDICATORS																			
Composite Trend	234	234	235	236	236	237	240	242	244	247	248	250	252	259	265				
Machinery and Equipment (BLS)	240	240	240	240	240	240	242	243	243	245	247	247	247	250	252				
Federal Salary	245	245	245	245	257	257	257	257	268	268	268	268	280	280	280				

## APPENDIX B — WIS'S REVIEW COMMENTS